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Dated 5 January 2005

Patents Form 1/77

Patent :1977
(Rule 16)

16 DEC 2003

The Patent Office

16DEC03 E857649-1 C26047
P01/7700 0.00-0329054.1 NONE

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

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1. Your reference — 0300370

2. Patent application number *(The Patent Office will fill in this part)* — 0329054.1 — 16 DEC 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

SMITHS GROUP PLC
765 FINCHLEY ROAD
LONDON
NW11 8DS

Patents ADP number *(if you know it)* — 8032310001

If the applicant is a corporate body, give the country/state of its incorporation — GB

4. Title of the invention

GAS-TREATMENT DEVICES

5. Name of your agent *(if you have one)* — J. M. FLINT

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

765 FINCHLEY ROAD
LONDON
NW11 8DS

Patents ADP number *(if you know it)* — 1063304001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	7
Claim(s)	
Abstract	SD
Drawing(s)	2 + 2

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature J M Flint Date 15/12/03

12. Name and daytime telephone number of person to contact in the United Kingdom

J. M. FLINT 020 8457 8220

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Notes

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GAS-TREATMENT DEVICES

This invention relates to gas-treatment devices.

The invention is more particularly concerned with heat and moisture exchangers (HMEs) or the like for use with tracheostomy tubes.

In normal breathing, inhaled air passes through the nose where it is warmed and moistened before passing to the trachea and bronchial passages. Where a patient breathes via a tracheal tube or laryngeal mask, gas is supplied directly to the trachea, by-passing the nose. The gas is, therefore, preferably warmed and moistened to prevent discomfort and damage to the lining of the trachea. This is often achieved by a heat and moisture exchange device or HME connected to the tracheal tube to receive both exhaled and inhaled gases. The HME has a moisture-absorbing element, such as a treated paper element or a foam, that absorbs moisture in exhaled gases and transfers a major part of this to the inhaled gases. The element also warms inhaled gas in the same way. HMEs are sold by Portex Limited of Hythe, England under the trade mark Thermovent. Examples of HMEs are described in: GB 2303307; GB 2321600; GB 2277689; GB 2268496; GB2267840; GB 2233904; EP 535016; EP 533644; EP 387220; EP 265163; EP 413127; US 4516573; US 4090513; US 4771770; US 4200094; and US 4048993. The HME may also include a filter for removing particles, bacteria and viruses from gas supplied to or from the patient.

The patient may have a tracheostomy tube that enables speech. Such tubes have openings or fenestrations above the sealing cuff to allow air from the lungs to pass to the

vocal folds. The tube also needs to be fitted with a valve that can be closed to prevent air escaping from the machine end of the tube so that it is diverted to the fenestrations when speech is required. It is also desirable to be able to provide a speech function when the tube is fitted with an HME. In one HME, the Atox Provox Trachphone, the user can block the opening momentarily by pressing down a lid that holds the suction valve.

It is an object of the present invention to provide an alternative gas-treatment device and assembly.

According to one aspect of the present invention there is provided a gas-treatment device for use with a tracheostomy tube, the device including a housing adapted for connection to the tube and having a gas passage therein, a gas-treatment element mounted with the housing in first position in which gas can flow from the tube through the gas-treatment element via the gas passage, the gas-treatment element being displaceable to a second position in which the gas passage is substantially blocked preventing flow of gas out of the tracheostomy tube.

The gas-treatment element is preferably an HME element. The gas-treatment element is preferably displaceable from the first position to the second position by rotation. The gas-treatment element may be cylindrical in shape. The gas-treatment element may include a treated paper.

According to another aspect of the present invention there is provided a tracheostomy tube assembly including a tracheostomy tube and a gas-treatment device according to the above one aspect of the present invention.

A tracheostomy tube assembly including an HME, in accordance with the present invention, will now be described, by way of example, with reference to the accompanying drawing, in which:

Figure 1 is a side elevation view of the assembly;

Figure 2 is a cross-sectional plan view of the HME in an open state;

Figure 3 is a perspective view of the HME in an open state;

Figure 4 is a cross-sectional plan view of the HME in a closed, speaking state; and

Figure 5 is a side elevation view of a modified HME.

With reference first to Figure 1 the assembly comprises a tracheostomy tube 1 and an HME gas-treatment device 2 connected to the rear, machine end of the tube. The HME device can be switched between an open state when it allows passage of air in and out of the tube and a closed state when it prevents gas emerging from the rear end of the tube.

The tracheostomy tube 1 is conventional including a curved shaft 10 with a sealing cuff 11 adjacent its forward, patient end 12. The shaft 10 has several fenestrations or openings 13 formed through its wall above the cuff 11 on the outside curve of the shaft. The forward part of the shaft 10 including the fenestrations 13 is positioned within the trachea 14, with the cuff 11 inflated to seal with the surface of the trachea. The rear, machine end 15 of the tube has a flange 16 by which the tube is secured with the patient's neck and a coupling 17 onto which the HME device 2 is fitted.

With reference now to Figures 2 to 4, the HME device 2 is of a cylindrical shape and is oriented to extend transversely of the rear end of the tube 1 and transversely of the axis of the trachea 14. The device 2 has a cylindrical outer housing 20 of a moulded plastics material which is open at both ends 21 and 22. Midway along its length the housing 20 has a circular opening 23 within a short, outwardly-projecting collar 24 shaped to fit onto the tracheostomy tube coupling 17. Diametrically opposite the opening 23 the housing 20 has a suctioning valve 25, which may be of any conventional kind, but typically comprises three resilient leaves 26 of segmented shape attached at their outside edge within a circular aperture 27 in the housing. The edges of leaves 26 normally abut one another substantially to seal the aperture 27 but can be opened by pushing a suction catheter or the like through the centre of the aperture, which separates the tips of the leaves.

The HME device 2 contains an HME element 30 which is also substantially cylindrical. The element 30 has a wire support frame 31 retaining two HME units 32 and 33, one at each end. The HME units 32 and 33 are of a paper treated with a hygroscopic material to enhance the absorption of moisture. The paper is preferably in strip form with lateral

corrugations rolled into a coil so that the corrugations form multiple parallel gas passages extending parallel to the axis. Alternative HME materials could be used, such as foam materials. The frame 31 also supports a blocking member 34 in the form of an impermeable circular sheet or plate having a diameter slightly greater than that of the opening 23. The blocking member 34 extends a part way around the circumference of the frame 31 and is located midway along its length, at the same position as the opening 23 and the suctioning valve 25. At one end of the HME element 30 the wire frame 31 is formed into an axially-projecting flange 35, which protrudes from the housing 20 and provides a finger grip. The flange 35 is preferably removable so that the HME element 30 cannot be moved out of its open position. The HME element could take various alternative forms, for example, the frame could be of a plastics material or it could be provided by stiffened paper. The blocking member could be a one-way valve that allows gas to flow into the patient but prevents exhalation from the machine end 15 of the tracheostomy tube 1.

The HME element 30 is rotatable about its axis within the housing 20 and is a close sliding fit so that it remains in whatever angular position to which it is moved. The inside of the housing 20 is formed with stops (not shown) that cooperate with the frame 31 to limit rotation of the element to 90°. In its normal, open position, as shown in Figures 2 and 3, the HME element 30 is positioned so that the blocking member 34 is displaced 90° from the patient opening 23. Air can be exhaled by the patient via the opening 23, flowing outwardly through the two HME units 32 and 33, and giving up the major part of its humidity and warmth to the units, as shown by the arrow heads marked "E" (exhalation) in Figure 2. The patient can also inhale through the device 2 when air flows in the opposite direction indicated by the arrow heads marked "I" (inhalation) in Figure 2. Air flowing in this direction takes up

the majority of the moisture and heat stored in the HME units 32 and 33 so that the air flowing to the tube 1 is warmed and moistened. With the HME element 30 in this position the tracheostomy tube 1 can be suctioned by inserting a suction catheter (not shown) through the suctioning valve 25, through the open structure of the frame 31, through the opening 23 and along the tracheostomy tube. When the patient wishes to talk he grips the flange 35 and rotates the HME element 30 through 90° to its closed position. In this position the blocking member 34 is located directly in front of the opening 23, thereby preventing gas flow between the HME device 2 and the tube 1. When the patient exhales, therefore, all the exhaled gas passes through the fenestrations 13 in the tube 1 and flows to the vocal folds to enable speech. Inhaled air passes to the lungs in the opposite direction. When the patient has finished talking he rotates the HME element 30 back to its original, open position.

The arrangement of the present invention can be of low weight, thereby minimizing forces on the patient at the site of the tracheostomy. A rotatable HME element that enables speech can easily provided for inclusion in some existing HME housings, thereby reducing cost. The HME element can easily be inserted, removed and replaced where necessary. The present invention also has the advantage that the device can be retained in the speech position without the need for continuous manual intervention. The HME could include HME elements of various different kinds and is not limited to any one kind. The HME does not prevent suctioning taking place.

The HME could include resilient means for returning the HME element to its open position when released, as shown in Figure 5. The modified HME element 30' shown in Figure 5 has two integral, springy teeth 131 formed with the frame 31' at opposite ends. The

teeth 131 project longitudinally at the outer edge of the frame 31' so that they lie against the inside surface of the housing 20'. In this embodiment, the housing 20' extends a short distance beyond the opposite ends of the HME element 30' and has an inwardly-projecting ramp formation 132 moulded into its inner surface at each end to one side of the teeth 131. The HME element 30' also has a short peg 133 extending radially outwardly midway along its length on the opposite side of the element from the teeth 131. The peg 133 locates in a short circumferential slot 134 through the housing 20 and projects outwardly a short distance so that it can be slid manually along the slot to rotate the HME element 30' through about 90°. Engagement of the teeth 131 with the ramps 132 urges the HME element 30' to the open position with the peg 133 at one end of the slot 134. When the user wishes to speak, he grips the peg 133 and slides it to the opposite end of the slot 134, thereby rotating the HME element 30' to the closed position. As the HME element 30' rotates, the teeth 131 bend resiliently by engagement with the ramps 132. When the user releases the peg 133, the teeth 131 tend to straighten and, by engagement on the ramps 132 rotate the HME element 30' back to its natural position. It will be appreciated that there are many different resilient arrangements that could be used to restore the HME element back to its original position.

The invention, in some of its aspects, is not confined to HMEs but could be used with other gas-treatment devices such as filters.

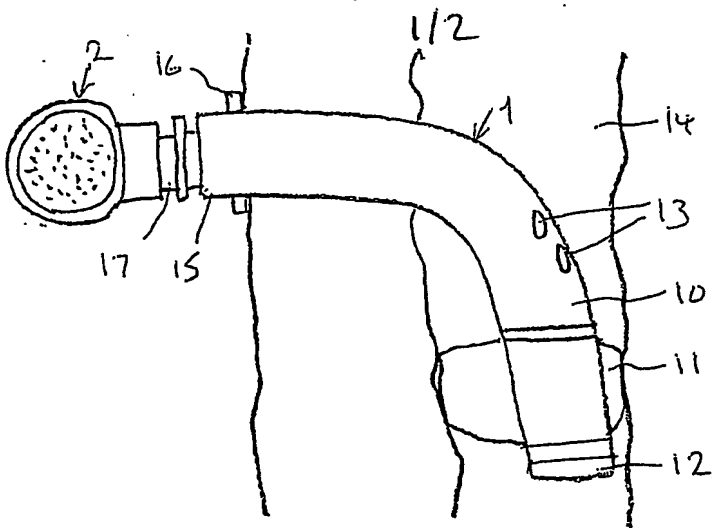

FIG. 1

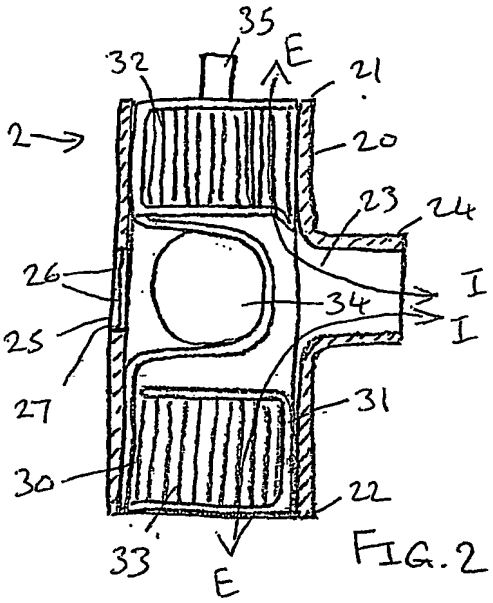

FIG. 2

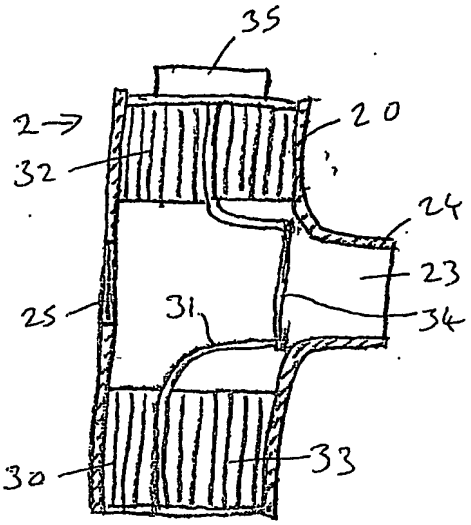

FIG. 4

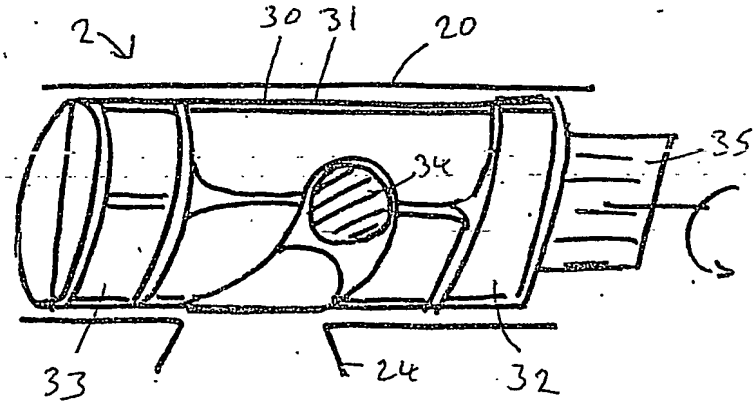

FIG. 3

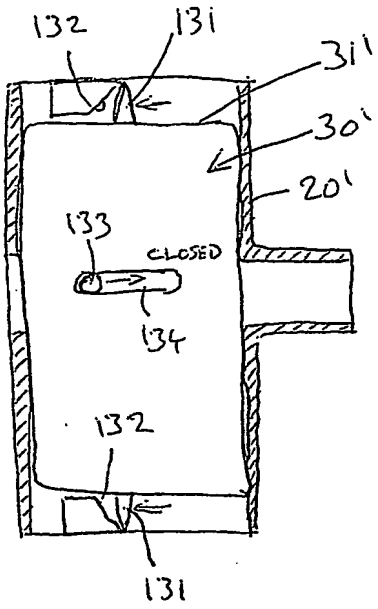

FIG. 5

Document made available under the Patent Cooperation Treaty (PCT)

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